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5 Protection, Trade Adjustment Assistance, and Income Distribution

Peter A. Diamond

5.1 Introduction

The income redistribution ability of government is severely limited. In the public finance literature, there has been considerable recent research exploring questions of taxation and public production where the potential gains from income redistribution are sizable. In some, but not all, cases the need for income redistribution changes the desirable rules for tax and production policy. In this paper a similar approach is taken to questions of protection and trade adjustment assistance. The focus is on the distribution of income among workers and the use of output and labor movement subsidization to maximize social welfare.

Protection policy can come in many forms including subsidies, tariffs, and quotas. In this paper I shall only consider subsidies. It is politically understandable that firms seek tariffs or quotas rather than subsidies. For the model analyzed here, subsidies are the efficient method of protection when protection is desired. Thus the analysis is simplified by considering them rather than tariffs which would introduce further distortion. The differences among subsidies, tariffs, and quotas are sufficiently well known that the reader will have no difficulty extending the analysis, should that be wanted. Similarly, I analyze a competitive industry, leaving to the reader the adaptation to other market settings.

Trade adjustment assistance is available separately to firms and to workers.[1] This paper considers only financial aid going to workers. There

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are many issues involved in the question of when it is socially advantageous to use public resources to improve and maintain firms that might otherwise go out of business. These issues are, in part, very different from those relevant for analysis of workers, whose continued existence is taken as given. Analysis of aid to firms that comes to grips with the efficiency and behavior of firms would be very interesting.

Adjustment assistance to workers comes in the form of services and advice as well as cash—McCarthy (1975) suggests that the former may well be very important in helping workers respond to their changed environment. Nevertheless, this analysis will only consider financial assistance for workers who are well able to look after their own interests. To go further would again raise a number of very different (and very interesting) issues.

When an industry is in long-term decline, the workers in the industry are likely to be poorer than taxpayers generally. Thus there is an equity basis for subsidizing the output of the industry to raise wages in the industry. Taken alone, this subsidy has the side effect of inefficiently decreasing exit from the industry. Even workers exiting from a declining industry are likely to be poorer than taxpayers generally. Thus there is an equity basis for subsidizing moving costs. Taken alone, this subsidy has the side effect of inefficiently encouraging too much exit from the industry. Combining these two policies, we have a gain in equity with offsetting incentives on exit. This paper explores the workings of and limitations on this combination of policies.

In section 5.2 is developed a simple model of a two-industry economy with labor as the sole factor of production. The model is used to derive optimal policies of protection and adjustment assistance. The special assumptions of the model are discussed in section 5.3. Sections 5.4 and 5.5 examine the case for adjustment assistance once one recognizes the prior existence of income taxation and unemployment compensation. This analysis was developed after reading McCarthy's analysis of the Massachusetts shoe industry, an industry in long-term decline. I have not asked how typical this industry is of recipients of adjustment assistance. At several places in the analysis, the results would be different if adjustment assistance were going to industries with only temporary difficulties.

5.2 One-Period Model

The basic elements of the analysis are brought out in this section in a one-period linear model. We consider an economy with two industries. The A industry is the one suffering from foreign competition. The B industry represents the rest of the economy. This is small-country analysis, and the relative output price of these two goods is set by the world market. For ease of interpretation of the equations we will distinguish the two absolute prices p_A and p_B. The economy has workers, but no other factors of production.

At the start of the single period, each worker is located in one industry or the other. There are two consequences to being a worker in a particular industry. One is that workers are assumed to be skilled in their trades and to become unskilled should they switch industries. A skilled worker has s times the marginal product of an unskilled worker. We shall measure output so that the marginal product of an unskilled worker is equal to one (which is assumed to be independent of the number of other workers). The second consequence of different initial placements is that there is a moving cost associated with switching industries. The costs are different for different workers. We will refer to a c worker as one with moving costs equal to c and denote by $N(c)$ the number of workers in the A industry with moving costs less than or equal to c. For convenience we will assume that there are some workers with moving costs c for every positive value of c, $N'(c) > 0$ for $c > 0$. N_A and N_B are the numbers of workers in each industry at the start of the period. Apart from location and moving costs, all workers are the same.[2] We denote by $v(I; p_A, p_B)$ the indirect utility function of a worker having income I and facing prices p_A and p_B. This will often be shortened to $v(I)$ when there is no confusion. We assume that the relevant normalization for social welfare has v concave in I.

We begin by considering full welfare optimization assuming the use of ideal lump-sum taxation. Since this model does not violate any assumptions of the Arrow-Debreu model, any Pareto optimum is achievable as a competitive equilibrium with appropriate lump-sum redistribution. Thus we need not consider any other policy tools until we start second-best analysis. Ideal lump-sum taxation has two characteristics—taxes can be different for different individuals and taxes do not vary with individual behavior. Since taxes do not vary, individuals decide whether or not to move by comparing income without moving to income net of moving costs.

We assume that the A industry is in decline in the sense that $p_A < p_B$. With workers receiving their marginal products, this implies that the workers who stay in the A industry have lower earned income than workers who stay in the B industry. Lump-sum taxation to maximize the sum of utilities will then transfer income from B workers to A workers to equate incomes.

If p_A is sufficiently close to p_B for the loss of skill from moving to be more important than the lower price, $sp_A \geq p_B$, then no workers will choose to move. In this case the lump-sum transfers will be the same for all A workers and will equate incomes across industries while balancing the government budget:

$$sp_A + I_A = sp_B + I_B, \quad (1)$$
$$N_A I_A + N_B I_B = 0,$$

where I_A and I_B are lump-sum transfers to workers in the two industries (with $I_B < 0$ corresponding to lump-sum taxation). Since these are lump-sum taxes, they depend on the individual and not his choice of industry—someone choosing to switch industries does not change his lump-sum transfer.

If p_A declines below p_B/s, individuals will choose to move. Since lump-sum transfers do not change with the moving decision, workers with moving costs below c_0^* will move, where the c_0^* worker has the same income in either industry:

$$sp_A = p_B - c_0^*. \quad (2)$$

Recalling that A workers are skilled in the A industry but unskilled in the B industry, the higher price of B output just offsets a c_0^* worker's moving costs and loss in skill.

In the absence of lump-sum transfers B workers would be better off than movers who would be better off than those staying as A workers. Ideal lump-sum taxation will equate the incomes of all workers. Denote by I_c the lump-sum transfer to a c worker. For $c > c_0^*$, the worker stays in the A industry. All such workers are in the same position and have the same lump-sum income I_A. For $c < c_0^*$, lump-sum income I_c will vary with c. These transfers equate all incomes and satisfy the government budget constraint:

$$sp_A + I_A = sp_B + I_B = p_B - c + I_c, \quad (3)$$

$$(N_A - N(c_0^*))I_A + N_B I_B + \int_0^{c_0^*} I_c \, dN(c) = 0. \quad (4)$$

For familiar reasons of limited information and administrative costs, this type of redistribution is assumed to be infeasible. Thus we shall consider a restricted set of policy tools.

5.2.1 Second Best

For constrained welfare maximization, we consider the use of two policy tools. The protection tool is the subsidization of output of the A industry. Let α be one plus the *ad valorem* subsidy rate. The adjustment assistance tool is the subsidization of moving costs. Let β be one minus the *ad valorem* subsidy rate.[3] These programs are financed by a poll tax—an equal per capita tax on all workers in the economy. Such a tax is feasible even when it is not feasible to ideally set lump-sum taxes which differ across individuals. As before we need to distinguish cases depending on the level of p_A. For $p_A \geq p_B/s$, it is inefficient to have any workers move. There is then no reason not to protect the A industry at a sufficient level to equate worker incomes in the two industries, $\alpha p_A = p_B$. In this case the poll tax T_1 must satisfy

$$(N_A + N_B)T_1 = (\alpha - 1)sp_A N_A. \tag{5}$$

With all incomes equated, social welfare satisfies

$$W_1 = (N_A + N_B)v\left(s\frac{(p_B N_B + p_A N_A)}{N_A + N_B}\right). \tag{6}$$

Note that this equilibrium is feasible for any p_A, not only high ones. The question is when this policy is optimal also for values of p_A below p_B/s.

The alternative policy is to restrict α so that some mobility occurs. This is only possible when $sp_A < p_B$. In this case, the worker who is just indifferent to moving has costs satisfying.

$$\alpha sp_A = p_B - \beta c^*. \tag{7}$$

The level of poll tax T_2 needed to finance these programs satisfies

$$(N_A + N_B)T_2 = (\alpha - 1)sp_A(N_A - N(c^*)) + (1 - \beta)\int_0^{c^*} c\,dN(c). \tag{8}$$

At fixed subsidy rates, an increase in c^*, increasing the number of moving workers, lowers the cost of protection and raises the cost of adjustment assistance.

Protection encourages workers to stay in the A industry. Adjustment assistance encourages them to leave. For each level of movement between industries $N(c^*)$, there is a locus of pairs of subsidy levels which will give the same amount of movement. These loci are shown in figure 5.1. All are straight lines passing through the point $(p_B/sp_A, 0)$. The locus that also passes through the point (1,1) has the same amount of movement as would occur in the absence of intervention. We shall consider the optimal pair of policies (α, β) as well as the optimal α for arbitrary β and vice versa.

Moving to the right along a constant movement locus, both protection and adjustment assistance increase, as do the lump-sum taxes to finance the subsidies. On the locus where the c^* worker is the marginal worker, taxes satisfy

$$(N_A + N_B)T_2 = (\alpha - 1)sp_A(N_A - N(c^*)) + \left(1 - \frac{p_B - \alpha sp_A}{c^*}\right)\int_0^{c^*} c\,dN(c). \tag{9}$$

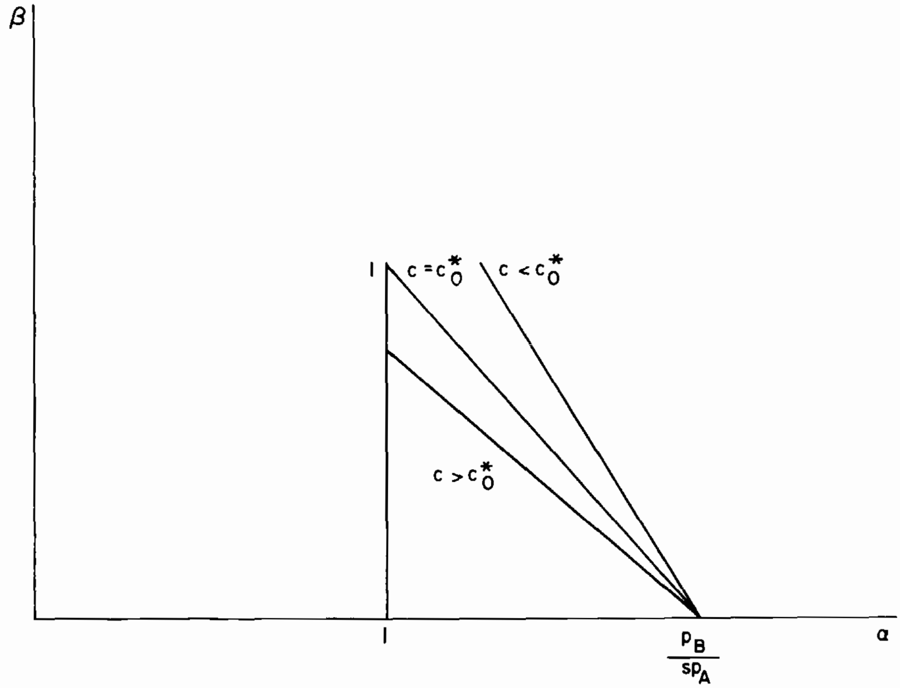

Fig. 5.1 Constant mobility loci

Thus the increase in taxes as subsidization increases satisfies

(10) $$\left.\frac{\partial T_2}{\partial \alpha}\right|_{c^*} = \frac{sp_A}{c^*(N_A + N_B)}\left[c^*(N_A - N(c^*)) + \int_0^{c^*} c\,dN(c)\right].$$

The B workers have incomes that fall at the rate of

$$\left.\frac{\partial T_2}{\partial \alpha}\right|_{c^*}$$

as we move to the right along such a locus. The A workers have incomes that rise at the rate

(11) $$\left.\frac{\partial(\alpha sp_A - T_2)}{\partial \alpha}\right|_{c^*} = \frac{sp_A}{c^*(N_A + N_B)}$$
$$\left[c^* N_B + \int_0^{c^*} (c^* - c)\,dN(c)\right].$$

The c' workers who move have incomes that change at the rate

(12)
$$\left.\frac{\partial(p_B - \beta c' - T_2)}{\partial\alpha}\right|_{c^*} = \frac{sp_A}{c^*(N_A + N_B)}$$

$$\left[c'N_B + \int_0^{c^*} (c^* - c)\, dN(c) - (c^* - c')N_A\right].$$

This expression is positive for high values of c' and negative for low ones. Thus movement to the right along this locus implies redistribution from the better to the worse off and welfare improves as we move toward the point where $\beta = 0$ and $\alpha = p_B/sp_A$, i.e., the point where everyone is indifferent to moving.[4] At this point the movers and the A workers have utility $v(p_B - T_2)$, while the B workers have utility $v(sp_B - T_2)$, where T_2 satisfies (9). To determine the optimum, we need to select c^*.

In deciding how many workers should move, the government wants to minimize the tax burden since minimizing T_2 maximizes both $v(p_B - T_2)$ and $v(sp_B - T_2)$. This occurs at the same level of movement as in the laissez-faire equilibrium $N(c_0^*)$, since this maximizes the value of net output at world prices.[5]

To complete the analysis of welfare maximization we must determine the values of p_A for which this equilibrium is better than the equilibrium with no movement and equalized incomes. With equalized incomes and no interindustry movement, welfare satisfies (6). In the constrained optimum with movement, welfare satisfies

(13)
$$W_2 = N_A v(p_B - T_2) + N_B v(sp_B - T_2),$$

where

$$(N_A + N_B)T_2 = (p_B - sp_A)(N_A - N(c^*)) + \int_0^{c^*} c\, dN(c),$$

(14)
$$c^* = c_0^* = p_B - sp_A/p_B.$$

To compare alternative policies, let us assume that workers do not consume the output of the A industry, so the only effect of a higher p_A is higher incomes of all workers. With equalized incomes and no movement we have full equality but inefficiency. With movement we have efficiency but inequality. We would expect the former policy to be better when sp_A is close to p_B and so movement is unimportant. This is the case since $W_1 > W_2$ at $p_B = sp_A$. Protection alone can be the preferred policy even at $p_A = 0$ for suitable utility function and sufficiently large s. Table 5.1 compares the alternative policies.

For the stronger result that W_1 is preferred if and only if p_A exceeds a critical value, we have a sufficient condition of increasing absolute risk

Table 5.1 **Alternative Policies**

	Only Protection	Protection and Assistance
α	p_B/p_A	p_B/sp_A
β	1	0
c^*	0	c_0^*
T	T_1	T_2

aversion. To see that this is the case, we differentiate social welfare with respect to p_A in both cases:

(15)
$$\frac{\partial W_1}{\partial p_A} = sN_A v'(sp_B - T_1),$$

$$\frac{\partial W_2}{\partial p_A} = s(N_A - N(c_0^*))\left(\frac{N_A v'(p_B - T_2) + N_B v'(sp_B - T_2)}{N_A + N_B}\right).$$

When W_1 equals W_2, W_1 is increasing more rapidly with decreasing absolute risk aversion since

$$(N_A + N_B)v(x) = N_A v(y) + N_B v(z)$$

(16)
$$=> (N_A + N_B)v'(x) > N_A v'(y) + N_B v'(z).$$

As p_A gets larger, the efficiency loss from no movement gets smaller $(sN_A > s(N_A - N(c_0^*)))$. For the redistribution gain to get larger, we need redistribution to be more important the greater the income level. This latter condition is not generally plausible, so the areas of dominance of each policy are not necessarily connected.

5.2.2 Single-Policy Tool

We have considered the simultaneous optimization of protection and trade adjustment. We now consider the use of each of these tools separately, the other tool held constant and assuming a sufficiently low p_A to justify some movement out of the A industry. The result of these calculations is that the optimum occurs with greater concern for income distribution than is the case if the free policy variable is set to produce the no-intervention level of movement.[6] This is shown in figure 5.2, where it is assumed that the social indifference curves are well behaved. Even when this is not the case, the optimum has the properties mentioned above.

With the policy tools set at arbitrary levels, social welfare satisfies

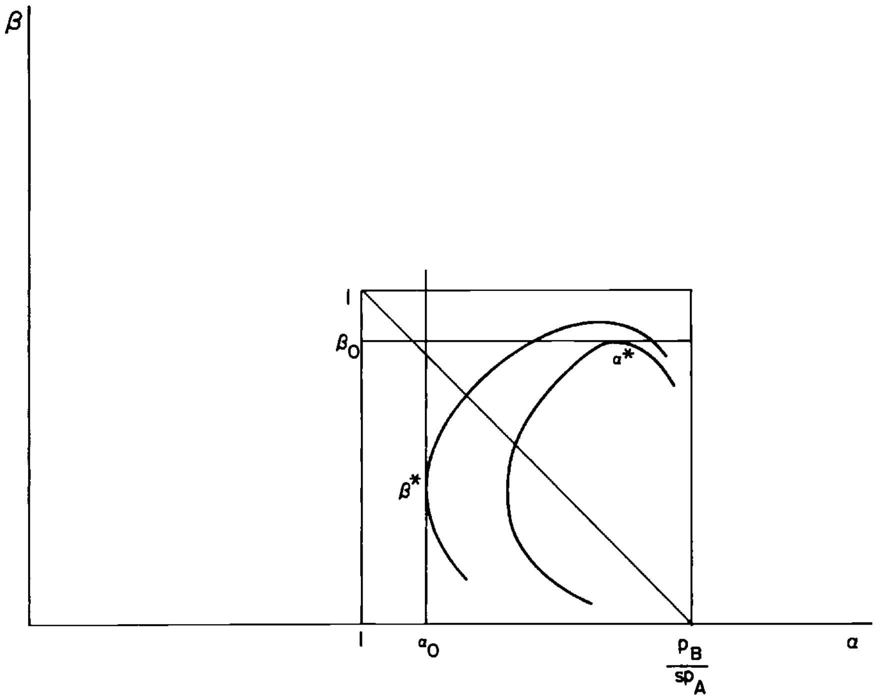

Fig. 5.2 Social indifference curves

$$W = \left[N_A - N(c^*)\right] v(\alpha s p_A - T)$$

$$+ \int_0^{c^*} v(p_B - \beta c - T)\, dN(c) \qquad (17)$$

$$+ N_B v(s p_B - T),$$

where c^* satisfies (7) and T satisfies (8). The derivative of W with respect to the poll tax T equals minus the average marginal utility of income of taxpayers in the economy, which is defined as

$$\overline{v'} \equiv \left[N_A - N(c^*)\right] v'(\alpha s p_A - T)$$

$$+ \int_0^{c^*} v'(p_B - \beta c - T)\, dN(c) \qquad (18)$$

$$+ N_B v'(s p_B - T).$$

Provided there are some movers in the economy,[7] B workers have greater income than movers who have greater income than A workers. Writing these marginal utilities as v'_A and v'_B, we have

$$v'_A \equiv v'(\alpha s p_A - T) > \overline{v'} > v'(s p_B - T) \equiv v'_B. \tag{19}$$

In addition we assume that the B industry is sufficiently larger than the A industry that the marginal utility of income of all the movers exceeds the average marginal utility of a taxpayer:

$$v'(p_B - T) > \overline{v'}. \tag{20}$$

With this additional assumption, we can evaluate the derivatives of W:

$$\begin{aligned}
\frac{\partial W}{\partial \alpha} &= (N_A - N(c^*)) s p_A v'_A - \overline{v'}(N_A + N_B)\frac{\partial T}{\partial \alpha} \\
&= (N_A - N(c^*)) s p_A v'_A - \overline{v'}\Big[s p_A (N_A - N(c^*)) \\
&\quad + N'(c^*)\frac{\partial c^*}{\partial \alpha}((1-\beta)c^* - (\alpha - 1) s p_A)\Big] \\
&= s p_A (N_A - N(c^*))(v'_A - \overline{v'}) \\
&\quad - \overline{v'} N'(c^*)\frac{\partial c^*}{\partial \alpha}(c^* - c_0^*),
\end{aligned} \tag{21}$$

$$\begin{aligned}
\frac{\partial W}{\partial \beta} &= \int_0^{c^*} - v'(p_B - \beta c - T) c\, dN(c) \\
&\quad - \overline{v'}(N_A + N_B)\frac{\partial T}{\partial \beta} \\
&= \int_0^{c^*} - v'(p_B - \beta c - T) c\, dN(c) - \overline{v'}\Big[- \int_0^{c^*} c\, dN(c) \\
&\quad + N'(c^*)\frac{\partial c^*}{\partial \beta}((1-\beta)c^* - (\alpha - 1) s p_A)\Big] \\
&= - \int_0^{c^*} (v'(p_B - \beta c - T) - \overline{v'}) c\, dN(c) \\
&\quad - \overline{v'} N'(c^*)\frac{\partial c^*}{\partial \beta}(c^* - c_0).
\end{aligned} \tag{22}$$

Considering the derivative with respect to α, we note that the first term is positive and the second is also positive when $c^* > c_0^*$ since c^* decreases with α. Thus, to find a value of α for which $\partial W/\partial \alpha$ is zero, we must have c^*

$< c_0$. Thus protection is carried beyond the point where the decline of the industry equals that in the absence of intervention. With protection as the only available tool, incomes of A workers are raised above the level which gives the no-intervention level of movement.

Considering the derivative with respect to β, we note that the first term is negative (by assumption [20]) and the second is also negative for $c^* < c_0$ since c^* is decreasing with β. Thus, to raise the incomes of movers, trade assistance is carried beyond the point which would yield the same movement as in the absence of intervention. Assuming they are well behaved (as need not be true), social indifference curves would appear as in figure 5.2, where β^* and α^* mark optimal policies for arbitrary policies α_0 and β_0, respectively.

5.3 Discussion of the Model

The analysis above uses a particularly simple model of an economy and has no policy variables other than the ones being analyzed. In this section we consider informally more general models of the economy. In the next two sections we reconsider these policy tools in the presence of income taxation and unemployment compensation. In Appendix C is a further discussion in responce to questions raised at the conference.

First, let us recap the basics of the analysis. We start with an industry where workers have low wages because of a fall in the world price of their output. The alternative to staying at low wages is to move out of the industry, bearing moving costs and a loss in skill. To improve income distribution, it is desirable to help these workers. If the fall in output price is not too large, the most efficient way to help them is to protect the industry, stifling movement out of the industry if there would be any. If the fall in output price is large, this policy is too expensive in terms of the efficiency loss from immobility. A better policy is then to have a lower rate of protection and to encourage mobility by subsidizing movement costs—that is, having trade assistance. By coordinating these two policies with the single margin of movement, it is possible to preserve the efficient level of movement. If only one of these two tools is available, it should be used with greater concern for income distribution than would preserve the efficient level of movement.

We turn now to considering various special aspects of the model. We shall consider the absence of capital, the use of a linear technology, the assumption of an inelastic labor supply, the use of a one-period model, the absence of firms and new workers, and the simple form of moving costs. The absence of domestic distortions (like excise taxation) avoids the familiar second-best complications of coordinating different policies or adapting to their noncoordination.

5.3.1 Absence of Capital

We have used a model with a single factor of production. To add more factors (capital for example) we would need to consider the extent to which other factors were mobile. If capital were immobile, we would only have to take account of the fact that protection raises the return to capital in the *A* industry. To evaluate this effect we would need to know the extent to which ownership of the *A* industry was narrow or wide through the stock market or indebtedness of the firms and then the income levels of the capital income recipients relative to that of taxpayers. To the extent that capital is mobile, protection would also retard movement out of the industry and so efficiency. Presumably these effects weaken the case for protection (relative to that stated above) and thus also weaken the case for trade adjustment assistance. Whether the case for protection disappears altogether would depend on the particulars of the case. Even if no protection is warranted, we have seen that there remains a case for trade adjustment assistance.

5.3.2 Linear Technology

The model assumed that the marginal products of labor in the two industries were independent of the numbers of workers in the two industries. With strictly concave production functions, labor mobility raises the wages of those remaining behind and lowers the wages in the industry receiving the additional labor. This change in the model does not alter the basic argument. In addition, with concave production functions there is a residual profit in both industries. Any change in the level of movement will change the two levels of profits and, in general, the aggregate too. The determinants of the sign of the effect are derived in appendix A. This indirect effect is in addition to the indirect effect of protection in raising profits. Being ambiguous in sign, this indirect effect could work either way in determining the desirable size of policies.

5.3.3 Inelastic Labor Supply

With labor supply variable, redistribution by raising wages involves a distortion not present with lump-sum redistribution. Institutional limitations on hours may make this point of little significance. Otherwise, optimal protection is presumably reduced somewhat, although the desirability of some protection is unaffected.

Labor supply can also be variable because new workers are coming into the *A* industry. If protection raises the number of such workers, we have a further distortion. This is unlikely to be a real issue in a seriously declining industry.

5.3.4 One Period Model

By considering a one-period model, we have ignored historical reasons for workers in the two industries to be systematically different as well as the effects of the anticipation of these policies on earlier entry into this industry. Both of these points are illustrated by considering a perfect foresight two-period model where workers know that the time trend of p_A is down relative to p_B. Let us assume that without government intervention individuals are just indifferent to the choice of industry at the start of period one, $(p_A(1) + p_A(2)/(1 + r)) = (p_B(1) + p_B(2)/(1 + r))$. Having the same lifetime incomes, workers who plan to stay in either industry in both periods have the same consumption plan. Having different time streams of earnings, they have different savings, with the A workers having greater wealth at the start of period two. Even though A workers have lower wages than B workers, they both have the same consumption level, giving no reason for redistribution. Even more striking is the position of those low-moving-cost workers who shift from A to B. They are the best off in the economy as revealed by their willingness to move. This *ex post* behavior has the *ex ante* implication that low-moving-cost workers are particularly attracted to the A industry, which is appropriate. Full subsidization of moving costs would undercut this incentive to attract those who are most efficient in moving.

While this model illustrates what can go wrong with naive application of the one-period model, it is unrealistic for the plight of the Massachusetts shoe workers. (It may be accurate for the Alaska pipeline workers.) It is not simple to evaluate the effects of protection and adjustment assistance on prior entry into particular industries in the face of uncertainty about future prices. Both expectation formation and savings behavior are underdeveloped areas of empirical economics, making it hard to quantify these effects. The fact of many missing markets in the presence of price uncertainty makes it hard to evaluate whatever effects occur. In this setting laisser-faire has no privileged claim to efficiency; the indirect effects of income redistribution policies may be favorable rather than unfavorable.[8]

5.3.5 Absence of Firms

The model recognizes two industries but distinguishes neither firms within the industry nor separate plants of indivdual firms. Declining industries are marked by the closing of plants and the bankruptcies of firms. While many workers are reemployed in other plants of the same firm or other firms, it is unlikely that this mechanism works with the efficiency assumed of mobility in the model. While this issue would be of relevance for analysis of the desirability of assistance to prevent the closing of plants or firms, it plays little role in consideration of aid to workers who move after shutdown. While protection tends to decrease plant shutdown, adjustment assistance makes workers less willing to accept low wages to keep plants open. Thus there remains a trade-off in policies to approximately preserve the mobility level.

Another facet of the existence of firms is the existence of uniform wage schedules. Layoff by firms will tend to be based on marginal products (which vary) relative to wages (which may not). Moving costs and skill losses are thus not the sole selection criterion for workers to move. Since concern about the costs of moving affect both productivity and wage bargaining, it is not obvious how far reality differs from the simple model.

5.3.6 Moving Costs

We have modeled individual moving costs as unaffected by their subsidization. There are three types of costs—foregone wages, financial moving costs, and psychological costs. We would expect increases in the level or extent of unemployment benefits to affect job acceptance criteria. This will be discussed below. Whether the subsidization of relocation expenses involves any distortions depends on the rules under which they are paid. Some forms of payment could lead to inefficiency because of the substitution of subsidized costs for unsubsidized costs. Depending on details, this might decrease the desirable level of subsidization, but does not remove the case for its existence. Psychological costs cannot be subsidized in the same way as financial costs. If formally introduced, they would enter the model in a parallel way to the loss in skill.

Another complication arises once we recognize that different individuals have different relative skills in the two industries. Since moving decisions reflect both skill losses and moving costs, differential treatment of these two elements will induce inefficiency. Appendix B extends the model to this case.

5.4 Income Taxation

In the absence of any other policies it is straightforward to make the income redistribution case for many market intervention policies. It is difficult to ignore the fact that the United States has a personal income tax, as do most other countries. There are then two bases for a primarily redistributive policy. One is that the political process has resulted in an income tax which has less redistribution than might be desired.[9] The other is that even the optimal use of an income tax can be improved upon by the coordinated use of supplementary policies in a complicated economy.[10] Both of these arguments strike me as valid. Since it would be off the main topic to discuss my views of the appropriate level of redistribution in the United States, I will confine my remarks to the second issue.

Apart from political limitations, income redistribution is limited by the induced inefficiencies of high marginal tax rates. Thus one can ask whether incentives create less of a problem for helping the beneficiaries of these policies than for individuals at the same income level in the general economy. There is a major argument which appears plausible, although I have not done any formal modeling to check its validity. When a poor group is separated out, its taxes can be reduced without necessarily affecting the taxes of those higher up the income distribution (except through the government budget constraint). This eases the strain between the taxes of low- and high-income individuals which comes from a nonlinear income tax structure. The critical element for this argument is that identification as a sufferer from import competition be negatively correlated with income, a plausible hypothesis.[11]

Most discussions of income taxation take place in one-period models. Yet for many government policies there appears to be greater concern for declining income than for low income per se (for example, social security), requiring use of a multiperiod model. While this outcome might just represent the relative political powers of those with low incomes and those subject to income declines, consideration of intertemporal models does raise insurance bases for concern about declining income. This is particularly the case once one recognizes the intertemporal dependence of individual utility functions and so the particular dislike of declining living standards. The relatively undeveloped state of this area limits this issue to a suggestion for future research.

5.5 Unemployment Compensation

In the United States, the annual income tax is already supplemented by unemployment compensation. Adjustment assistance increases the level and duration of benefits. Thus it is appropriate, again, to ask whether there is a case for a larger program for workers in industries hurt by foreign competition. In answering, it seems useful to distinguish declining industries from those temporarily hurt—that is, to distinguish between industries from which there is steady exit and those needing temporary layoffs.

In the previous section it was argued that the presence of a progressive income tax did not eliminate the case for using additional tools to provide income to poor groups. By identifying a separate group, it becomes possible to transfer income to that group without lessening the taxes of those higher up the income distribution. Here we consider a different issue. Assuming the recipients of unemployment compensation to have approximately the same lifetime income levels as the recipients of trade adjustment assistance, is there a case for supplementing unemployment compensation for those laid off from declining industries? Since the theory of unemployment compensation is relatively underdeveloped, I will identify questions that need answering rather than reasons for the existing program. Thus I shall review the issues about unemployment compensation to see the extent to which they might apply differently to trade-impacted workers. First, we will consider conditions of their layoff, then the characteristics of the workers.

Unemployment compensation provides automatic stabilization for business cycles. Presumably the layoffs of trade-impacted workers are less correlated with general business declines than general layoffs. This offers no basis for supplementary benefits.

Baily (1977) and Flemming (1978) have argued that unemployment compensation is a form of worker insurance. The risk aversion of workers, compounded by capital market imperfections, gives considerable scope for insurance to ease the burden of this risk. From this perspective, the insurance provided is limited by its effects on worker behavior, to which we turn next. Conceivably remaining a long time in a declining industry might make trade-impacted workers more risk averse than others. The question could be approached by comparing the wealth levels of different groups of the unemployed.

Unemployment compensation affects incentives for layoffs, search intensity, and job acceptance.[12] Precisely because these workers come from a declining industry there is not the same concern for the excessive use of temporary layoffs. The argument would not be the same if adjustment assistance were available for industries which were temporarily impacted by foreign trade.

Much of the discussion of the incentives created by unemployment compensation assumes that there are no externalities caused by the behavior of the unemployed. Then, benefits play the same role as a distorting tax and we have the familiar trade-off of efficiency with equity and insurance. However, once one recognizes the lags and imperfections in the flows of information in the labor market it is not plausible to assume an absence of externalities caused by the behavior of the unemployed. Greater search intensity by the unemployed generates external economies to jobs which are filled as a consequence of this additional search.[13] Greater selectivity in job acceptance increases vacancies, and so the rate and quality of job offers received by other unemployed workers. Since greater selectivity involves passing up poor job matches, the average quality of matching is improved.[14] Greater unemployment benefits worsen the external diseconomy from too little search but, up to a point, improve the external economy from rejecting bad jobs. Without substantial evidence, I take the second effect to be more important than the first. This then creates a case for unemployment compensation even if workers are risk neutral. The question at hand, however, is whether trade-impacted workers differ from other workers. They may well since they may be making larger changes in both locations and industries than the typical worker. Whether empirically this is the case and whether theoretically this would imply a larger optimal benefit are questions I cannot answer. They must await further research.

Unemployment compensation distinguishes a number of worker characteristics in determining benefits—recent work for eligibility, wage level for benefit level and replacement rate, presence of dependents for additional benefits in some states. There are many other characteristics which are not distinguished. In particular, age affects employability. Another question for future research is whether trade-impacted workers differ from typical insured workers in ways which would justify larger or longer benefits but which are not distinguished in the determination of benefits.

Of course, there remains the argument that additional adjustment assistance is needed to offset desired protection.

5.6 Open and Closed Economies

Industries decline for many reasons. Is there any good reason to distinguish industries by whether the decline comes from rising imports or increased production elsewhere in the domestic economy? (This is separate from the issue that domestic politics are different in the two cases and the question whether one should distinguish declining industries from other sources of low wages and unemployment.) My casual impression is that the answer is no (ignoring macroissues as is encouraged by international agreements). That is, if one introduced the A' industry to the model in section 5.2 in place of international trade, the analysis would be similar if the fall in p_A came from increased productivity in the A' industry. The lack of difference between open and closed economies may be enhanced by the fact that the optimal policies in the face of serious decline retain the flow of workers out of industry A by combining adjustment assistance with protection. Of course, with a domestic A' industry it may be administratively difficult to distinguish the A and A' industries in the design of protective policies.

While the similarity of conclusions in open and closed economies seems strong, let me end on a cautionary note. Protection and adjustment assistance are predicated on government policies that contribute to industry decline (e.g., reduced tariffs) and not just industry decline. This distinction has been ignored in this paper. There is an analogy in the much studied provision of the United States Constitution that the government not take property without just compensation. It might be worthwhile to explore that analogy.[15]

5.7 Concluding Remarks

I have focused on the purely economic basis for both protection and adjustment assistance policies. In the absence of perfect income redistribution and perfect certainty about future economic development, there is a case for the use of these policies. This analysis needs supplementation to consider the political role of these two policies in affecting trade policy.

Appendix A *Nonlinear Model*

Assume that capital is immobile and output is determined by the production functions $F_A(s(N_A - N(c)))$ and $F_B(sN_B + N(c))$. Then movement is determined by the equation

$$\alpha s p_A F_A' = p_B F_B' - \beta c^*. \tag{A1}$$

In addition to the direct effect on incomes when protection is decreased or trade adjustment assistance increased, there is the indirect effect that the induced increase in movement raises wages in the A industry and lowers them in the B industry.

Next, we examine the effect of mobility or total capital income

$$\begin{aligned} I^k = I_A^k + I_B^k = &\left[\alpha p_A F_A - \alpha s(N_A - N(c))p_A F_A'\right] \\ &+ \left[p_B F_B - (sN_B + N(c))p_B F_B'\right] \end{aligned} \tag{A2}$$

In addition to the direct effect of changes in α and β on capital income, there is an indirect effect

$$\begin{aligned} \frac{1}{N'(c)}\frac{\partial I^k}{\partial c} &= -\alpha s^2(N_A - N(c))p_A F_A'' \\ &\quad + (sN_B + N(c))p_B F_B'' \\ &= -\alpha s p_A F_A' \varepsilon_A + p_B F_B' \varepsilon_B, \end{aligned}$$

where ε_i is the elasticity of the marginal product with respect to effective labor. This indirect effect reflects three elements. Workers lose their skills upon switching industries. Thus, they contribute less to effective labor in the new industry than in the old. Any difference in elasticities between industries implies different magnitudes of wage bill increases and decreases in the two industries from a transfer of the same amount of effective labor between industries. The presence of moving costs implies that the values of marginal products are not equal in the two industries. Thus the effect in the high-marginal-product industry is of greater importance.

This analysis rests critically on the particular assumption made concerning the way that skilled and unskilled labor enter the production function.

Appendix B

The model in section 5.2 assumed that all workers were the same, apart from moving costs. Here we introduce a second difference—skill in the B industry should the worker move. Thus we have a double index for workers (s_B, c), with $m(s_B, c)$ as the density of the index among A workers (m is not normalized to integrate to one). Workers with high s_B and low c will choose to move.

For a given α and β we define the critical value for movement s_B^* $(c; \alpha,\beta)$ by the equality of incomes in the two industries:

$$\alpha s p_A = s_B^* p_B - \beta c. \tag{A4}$$

We write the level of movement in the absence of intervention as s_B^0 (c). We shall only consider cases where some movement is desirable. As before, we assume poll taxes are used to finance the subsidies.

Social welfare can be written as a function of α and β:

$$\begin{aligned} W(\alpha,\beta) &= v(\alpha s p_A - T)(N_A - \textstyle\int_0^\infty \int_\xi^\infty m(s_B,c)\, ds_B\, dc) \\ &\quad + \textstyle\int_0^\infty \int_\xi^\infty v(s_B p_B - \beta c - T) m(s_B,c)\, ds_B\, dc \\ &\quad + v(s p_B - T) N_B, \end{aligned} \tag{A5}$$

where $\xi = s_B^*(c,\alpha,\beta)$ and where taxes satisfy

$$\begin{aligned} (N_A + N_B)T &= (\alpha - 1) s p_A (N_A - \textstyle\int_0^\infty \int_\xi^\infty m(s_B,c)\, ds_B\, dc) \\ &\quad + (1-\beta) \textstyle\int_0^\infty \int_\xi^\infty c\, m(s_B,c)\, ds_B\, dc. \end{aligned} \tag{A6}$$

As before, we define $\overline{v'}$ as the average marginal utility of income of taxpayers. For convenience we write the equilibrium number of movers as M. Differentiating W, we have

$$\begin{aligned} \frac{\partial W}{\partial \alpha} &= s p_A v'(\alpha s p_A - T)(N_A - M) - \overline{v'}(N_A + N_B)\frac{\partial T}{\partial \alpha} \\ &= s p_A v'(\alpha s p_A - T)(N_A - M) - \overline{v'}\Big[s p_A (N_A - M) \\ &\quad + \textstyle\int_0^\infty ((\alpha - 1) s p_A - (1-\beta)c) m(s_B^*,c) \dfrac{\partial s_B^*}{\partial \alpha}\, dc\Big] \\ &= s p_A (N_A - M)(v_A' - \overline{v'}) - \overline{v'} s p_A p_B^{-1} \textstyle\int_0^\infty ((\alpha - 1) s p_A \\ &\quad - (1-\beta)c) m(s_B^*,c)\, dc \\ &= s p_A \{(N_A - M)(v_A' - \overline{v'}) - \overline{v'} \end{aligned} \tag{A7}$$

$$\int_0^\infty (s_B^* - s_B^0) m(s_B^*, c)\, dc\},$$

$$\frac{\partial W}{\partial \beta} = - \int_0^\infty \int_{s_B^*}^\infty c v'(s_B p_B - \beta c - T) m(s_B, c)\, ds_B\, dc - \overline{v'}(N_A + N_B)\frac{\partial T}{\partial \beta}$$

(A8)

$$= - \int_0^\infty \int_{s_B^*}^\infty c(v' - \overline{v'}) m\, ds_B\, dc - \overline{v'} \int_0^\infty ((\alpha - 1) s p_A - (1 - \beta) c) m \frac{\partial s_B^*}{\partial \beta}\, dc$$

$$= - \int_0^\infty \int_{s_B^*}^\infty c(v' - \overline{v'}) m\, ds_B dc - \frac{\overline{v'}}{p_B} \int_0^\infty c((\alpha - 1) s p_A - (1 - \beta) c) m\, dc$$

$$= - \int_0^\infty \int_{s_B^*}^\infty c(v' - \overline{v'}) m\, ds_B\, dc - \overline{v'} \int_0^\infty c(s_B^* - s_B^0) m(s_B^*, c)\, dc.$$

These equations are similar in form to those in section 5.2 when only one policy variable was employed. (The similarity would be more striking if the cutoff were written as $c^*(s_B)$ rather than $s_B^*(c)$.) In the absence of intervention ($\alpha = 1$, $\beta = 1$, $s_B^* = s_B^0$) we see that $\partial W/\partial\alpha > 0$ and $\partial W/\partial\beta < 0$, assuming that movers have lower incomes than the average taxpayer.

Given the level of protection, adjustment assistance encourages movement by those with higher costs and lower skills in the B industry than would be efficient. This inefficiency is the source of the second-best nature of the results. The net effect of both policies on the size of the A industry can be written as

(A9) $$M^* - M^0 = \int_0^\infty \int_{s_B^*}^{s_B^0} m(s_B, c)\, ds_B dc.$$

Without restrictions on m, this need not be signed at the optimal policy. If the distribution is uniform over some region (with c ranging from $\underline{c}$ to $\bar{c}$), we can use (A7) to sign the difference in movement:

(A10) $$(M^* - M^0) = m \int_{\underline{c}}^{\bar{c}} (s_B^0 - s_B^*) dc < 0.$$

Thus the inefficiency in induced movement and the desire to aid those with low incomes result in a larger A industry than would occur without intervention. Presumably different assumptions on the differences among workers would lead to the opposite conclusion in some cases.

Appendix C *Relation to More General Models*

The model in the text has been made startlingly simple to bring out the essentials of the analysis. In the conference discussion, questions were raised as to the implications of taking the simple version literally. In this appendix I discuss general ways of extending the model to deal with the questions raised. These extensions are consistent with the basic idea of a small *A* industry and a large *B* industry representing the rest of the economy.

1. *Moving costs.* The technology of moving workers between industries was unspecified. With no change in the analysis we could have moving be done by *B* workers who have equal productivity in the *B* industry or the moving industry. Alternatively, moving can simply use the output of the *B* industry.

2. *Intertemporal setting.* The model has a single period. If we append a future to the economy, moving workers will presumably acquire skills in the *B* industry. The difference between the marginal products of skilled and unskilled workers then represents the difference in present discounted values given the different trajectories of marginal products of already skilled and presently unskilled workers.

3. *Initial position.* The model has a single period. If we append a past to the economy, we must be sure we can find one which yields the posited initial position. In conventional trade theory, the assumed linear technology would have led to specialization. This implausible and unrealistic knife-edge character of equilibrium is easily removed by the introduction of nonlinear technology or differences among workers. As an example of the latter, there might be moving costs from geographically disbursed initial positions at completion of schooling to job locations in the two industries. Then both industries will exist for a range of initial positions. Similarly, there could be differing comparative advantages in learning different initial skills. Alternatively, once we recognize the reality of transport costs we can again have both industries. Since the *B* industry represents the rest of the economy, it could be disaggregated to several industries, some of which are coming into existence at the same time that the *A* industry is declining.

4. *Nonconsumption of A goods.* The analysis of each of the two policies used no restrictions on worker utility functions (other than regularity). In attempting to distinguish the cases when each of them is superior, the simplifying assumption was added that workers did not consume the output of the *A* industry. This was the limiting case of the perspective that the *A* industry is small in this economy—we can ignore the utility effect of a fall in the price of shoes. Even with this assumption no satisfactory condition was found for the two regions of superiority of the two alternative policies to be connected sets. Introduction of another

set of consumers (e.g., capitalists) would permit the same assumption on workers and the continued production and import of A goods.

Notes

1. Assistance is also available to towns. This raises the interesting question of the relative merits of encouraging movement of workers and of jobs.

2. This is a substantial assumption. There are many other ways in which workers differ. For an extension of this model to one further dimension of difference, see appendix B.

3. We assume the restrictions $\alpha \geq 1$, $0 \leq \beta \leq 1$. That is, subsidization of moving costs beyond 100 percent is assumed to result in unacceptable levels of moving costs because of the moral hazard problem.

4. We assume that the government is free to select the movers when everyone is indifferent to moving. Otherwise there is, strictly, no optimum and we want to be as close as possible to this point.

5. Taxes per capita are given in (14). This expression is minimized when $c^* = c_0^*$.

6. This assumes that the A industry is small relative to the B industry.

7. That is, we assume $\alpha s p_A < p_B$ when α is arbitrary or optimal.

8. See Hart (1975) and Diamond (1980).

9 It is not an acceptable argument against further redistributive policies that the existing income tax is the outcome of a democratic political process. If further redistributive policies are accepted, then they too become the outcome of a democratic political process.

10. For an analysis of income taxation in a many-commodity economy see Mirrlees (1976).

11. In addition to the Mirrlees reference above see Akerlof (undated).

12. See Feldstein (1976), Mortensen (1979), and Diamond (1981).

13. From an efficiency perspective this is more important than the external diseconomies to workers who otherwise would have found these jobs. (See Mortensen 1979.)

14. See Diamond (1981). Both this paper and that of Mortensen assume workers are, *ex ante*, identical. It would be good to have analysis of these issues where workers and jobs differ systematically *ex ante*.

15. It has been suggested that there is a fruitful analogy between the problem studied here and the question of the assignment of liability. The latter question involves a technological externality. However, the question studied here is, at base, a pecuniary externality.

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Comment *John S. Chipman*

Diamond postulates a two-commodity open economy with a Ricardian technology, in which there are two special features: (*a*) workers' skills are specific to the industries in which they are initially employed, and their marginal productivity in these industries is s times what it would be in the alternative industries ($s > 1$); (*b*) there are moving costs to switching from one industry to the other.

Most of the complicated analytics of the paper flow from feature (*b*). The moving costs are stipulated to be "financial," and yet we are told that "this model does not violate any assumptions of the Arrow-Debreu model." If the latter statement is true, moving must use up real resources—either domestic or foreign. If domestic, one would like to see some explicit assumptions about the form of the production function for moving. The one-period formulation also appears to exaggerate the importance of moving: moving is a once-for-all decision, whereas income is earned period after period. For younger people, the cost of moving may be considered to be quite low compared with the present value of the interindustry differential in wages. Since I have doubts concerning the importance of moving costs—which in any event are not given a precise formulation in terms of resource use in this paper—and since, moreover, many of the difficulties I have with the paper subsist even if moving costs are ignored, I shall confine the remainder of my remarks to a discussion of these difficulties.

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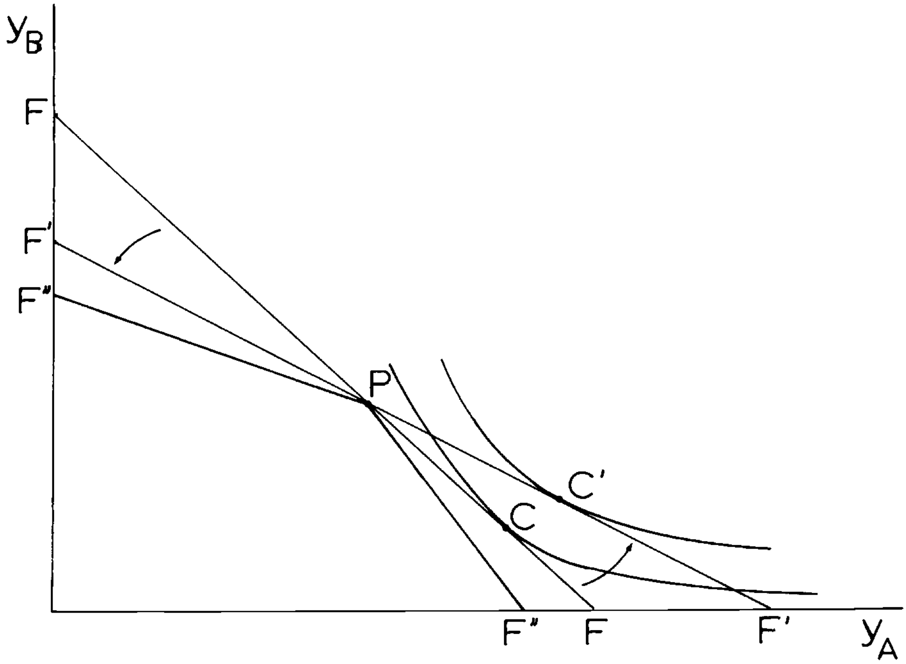

Fig. C5.1

One unanswered question is, How is it that in the initial situation, all workers are skilled in their trades? The only plausible answer is that they learned them on the job. One then wonders why they are assumed not to be able to acquire skills in new trades.

If some learning process led the economy to the initial equilibrium—so that the initial equilibrium may be regarded as one of the classical Mill-Graham variety—then if the country is truly a "small country," it would have been specializing in a single export good (commodity *B*). But on the contrary it is assumed to produce both goods; so it must have been a "large country," whose cost ratio dominated the world price ratio in Graham fashion. But then what reason would there be for the world price ratio to change?

Setting aside the above perplexities, let us accept the hypotheses and see what they imply. In figure C5.1 I show a straight-line Ricardian production-possibility frontier *FF* indicating the long-run transformation rate (in the absence of learning) between the outputs y_A and y_B of commodities *A* and *B* (the import and export good, respectively), which I also take to indicate the initial price ratio. Behind it is the broken linear-programming type of production-possibility frontier *F''PF''* re-

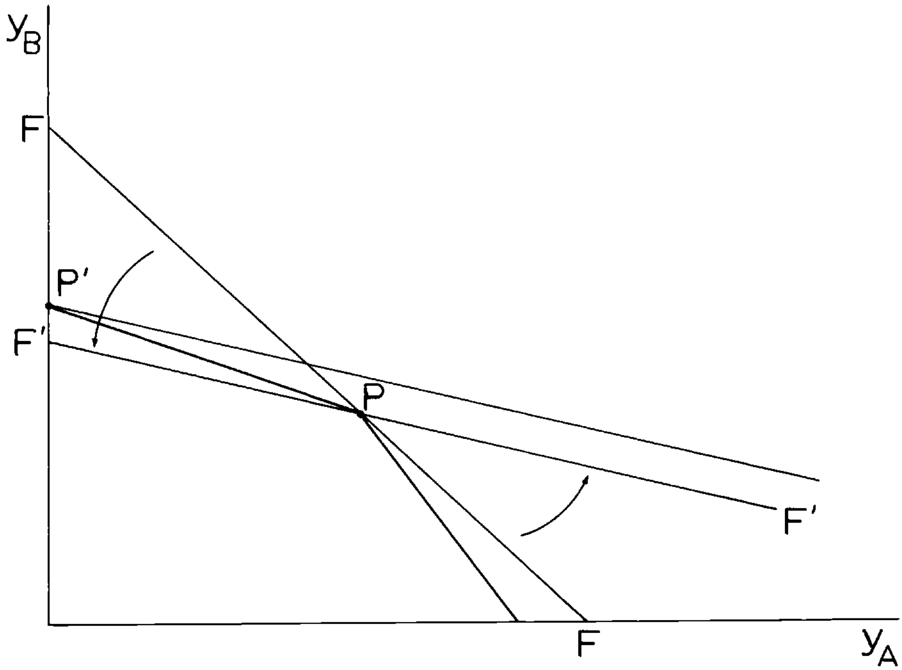

Fig. C5.2

sulting from feature (*a*). If the import price falls, the price line will swing counterclockwise around the initial production equilibrium point *P*, to the position *F'F'*, say. Given any Bergson-Samuelson social-welfare function, with optimal lump-sum transfers the economy would move to a higher social indifference curve, from *C* to *C'*, as shown. On the other hand, it is an immediate consequence of the Stolper-Samuelson theorem that real wages of the workers specific to the import-competing industry would decline and those of the workers specific to the export industry would rise. Diamond is concerned with devising a compensation scheme that would equalize workers' incomes and at the same time encourage workers to move out of the import-competing industry should the fall in import prices be so great as to require it (see figure C5.2). In the absence of moving costs, as figure C5.2 makes clear, the country would have to specialize in its export good henceforth, at the point *P'*; Diamond's moving costs are what prevent the efficient outcome from being a corner solution.

Or are they? Diamond states, "To compare alternative policies, let us assume that workers do not consume the output of the *A* industry, so that the only effect of a higher p_A is higher income of all workers." Under this

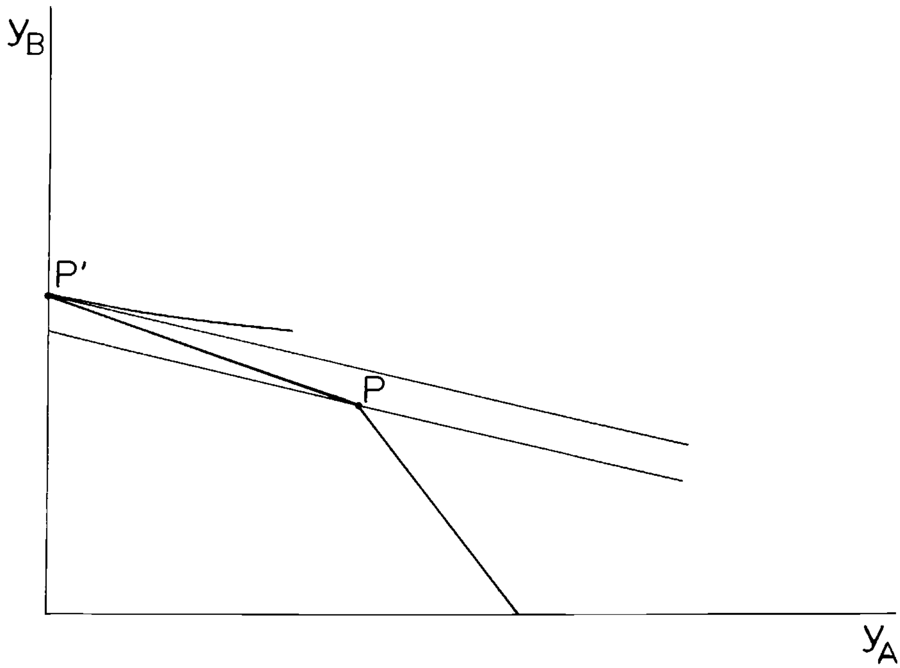

Fig. C5.3

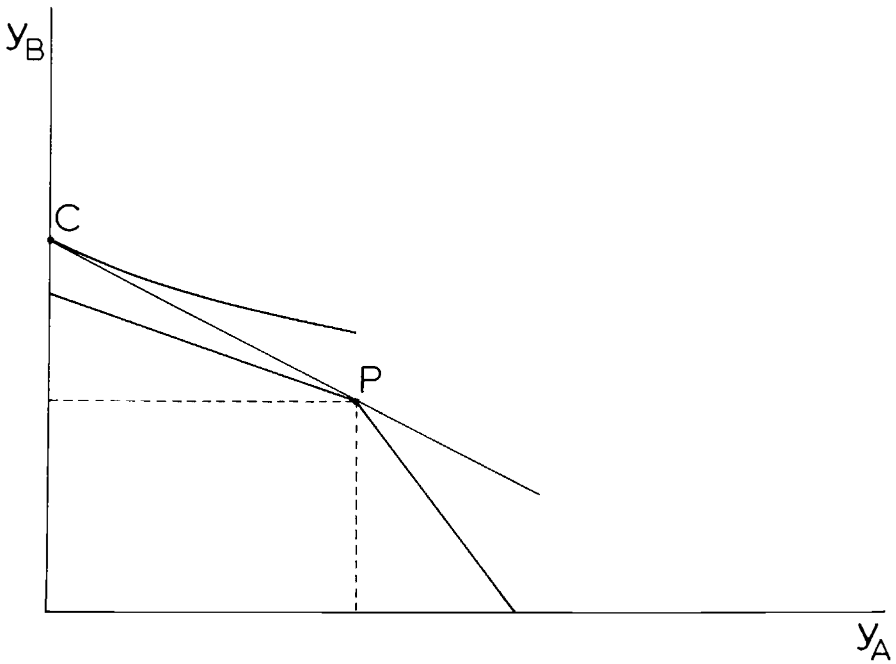

Fig. C5.4

assumption, either no amount of the *A* good will be produced (i.e., production and consumption will be at *P′* in figure C5.3) and hence there will be no trade—either before or after the price change; or some of the *A* good will be produced (say at *P* in figure C5.4) but it will all be exported (consumption being at *C* in figure C5.4). In neither case will there be any imports of commodity *A*. How can workers be damaged by the influx of cheap Japanese cars unless someone is buying cheap Japanese cars?

My final perplexity has to do with the absence of any consideration of incentives. Unless there is a wage differential between the two industries, or some other inducement, what is to provide the incentive for workers to improve their skills in their new jobs?

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